



Our File 83815-1402

EXAMINER Shawna Jeannine Shaw

GROUP 3737

APPLICANT Laura McIntosh et al.

SERIAL NO: 10/089,314

FILED August 5, 2002

FOR Non-Invasive Screening of Skin Diseases by Visible/Near-Infrared Spectroscopy

Commissioner of Patents

Washington, D.C., 20231

U.S.A.

Dear Sir:

DECLARATION

I, Michael Jackson, Group Leader for Biosystems at the Institute for Biodiagnostics, National Research Council of Canada, 435 Ellice Avenue, Winnipeg, Canada, am one of the inventors of the above-identified patent application.

I hereby declare that:

The instant invention is directed to a method of analyzing a skin portion affected with a skin disease with visible or near-IR light which is then used to generate a spectrum of the skin portion affected with the skin disease. A second control or comparison spectrum is taken of a skin portion of the same patient which is not affected with the disease and the two spectra are compared, as discussed in the application as filed. The result is then used to diagnose or identify or categorize the lesion. This result is then used to determine whether or not a biopsy is performed on the skin lesion, that is, whether or not the lesion is malignant or benign.

Thus, the instant invention allows for an initial screening of skin lesions to determine if the skin lesion is possibly malignant or may become

malignant (actinic keratoses, basal cell carcinoma, dysplastic nevi) or are benign (banal nevi, seborrheic keratoses actinic lentigines). Previously, diagnosis was difficult and could often lesions could only be distinguished following a biopsy, which is invasive and time-consuming.

Specifically, "Actinic keratoses" are reddish, rough areas of damaged skin which are considered pre-malignant. A small percentage of these lesions develop into the malignant tumor, squamous cell carcinoma.

"Basal cell carcinoma" or BCC refers to a slow-growing malignant epithelial neoplasm. This type of cancer is usually "cured" by surgical removal if caught early.

"Actinic lentigines" are small benign pigmented lesions often referred to as age or liver spots.

"Dysplastic nevi" refer to atypical moles which are considered to be pre-malignant or at greater risk of becoming malignant.

"Seborrheic keratoses" are common light brown to black skin growths that are benign.

"Banal or benign nevi" are common benign moles.

Thus, using the instant invention, banal nevi, which are benign, can be distinguished from dysplastic nevi which should be removed (see page 14, lines 17-19 of the application as filed). Similarly, actinic keratoses which are pre-malignant lesions can be distinguished from seborrheic keratoses which are benign (see page 14, lines 25-27 of the application as filed). In some embodiments, once a skin lesion has been identified as malignant, a biopsy is carried out to confirm that the lesion is malignant. However, when the lesion is identified as a benign skin condition, no biopsy is necessary. This is an advantage in that fewer biopsies need be carried out and as discussed on page 15 of the application as filed, the test could be performed by a non-specialist.

I declare that all statements made therein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment or

both under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the instant patent application or any patent issuing therefrom.

SIGNED at WINNIPEG
(place of execution)

this 29th day of MARCH, 2005

M. Jackson
Michael Jackson

CURRICULUM VITAE

Name: Mike Jackson

Date of birth: 30/9/62

Marital status: Single

Nationality: British (Landed Immigrant in Canada)

Home Address:

#301, 7 Evergreen
Evergreen Place
Winnipeg
Manitoba
R3L 2T9
Tel: (204) 477 1992

Work Address:

Institute for Biodiagnostics
435, Ellice Ave
Winnipeg
Manitoba
R3B 1Y6
Tel: (204) 984 4627

Education and Employment:

1981-1984: BSc (Hons) Physiology. Courses taken: physiology, pharmacology, medical biochemistry, microbiology, biological statistics. Dept. Physiology, Stopford Building, University of Manchester, Oxford Rd. Manchester, UK.

1985-1985: Animal technician, Dept. Psychiatry, Stopford Building, University of Manchester, Oxford Rd, Manchester, UK.

1985-86: MSc Instrumentation and Analytical Science. Courses: feedback and measurement, analytical instrumentation, principles of spectroscopy, measurement in the life sciences. Dept. Instrumentation and Analytical Science, University of Manchester Institute of Science and Technology, Sackville St., Manchester, UK.

1986-90: PhD, Biochemistry. Supervisor, Prof. Dennis Chapman, FRS. Dept. Of Protein and Molecular Biology, Royal Free Hospital School of Medicine, London, UK. Thesis: "Fourier Transform Infrared Spectroscopic Studies of Biomolecules", involved IR studies of calcium binding proteins and lipid polymorphism.

1990-1992: Research Associate with Dr. Henry H. Mantsch, Steacie Institute for Molecular Science, NRCC, Ottawa, Ontario, Canada. Characterisation of conformation of proteins, polypeptides and peptides by FT-IR spectroscopy. FT-IR spectroscopic studies of lipid-peptide interactions and protein-solvent interactions.

1992-1994: Research Associate with Dr. Henry H. Mantsch, Institute for Biodiagnostics, NRCC, 435 Ellice Ave. Winnipeg, Manitoba, Canada R3B 1Y6. Involved in developing infrared technology for the diagnosis of 1) multiple sclerosis 2) Alzheimer's disease 3) arthritis 4) breast cancer based upon spectra of biopsied tissue. Development of methods to aid understanding of the molecular basis of the disease process. Supervision of summer students and graduate students.

1994-1996: Assistant Research Officer, Spectroscopy Group, Institute for Biodiagnostics, NRCC, 435 Ellice Ave., Winnipeg, Manitoba, Canada R3B 1Y6. Involved in development of ex vivo IR technologies for diagnosis of neurological disorders (Alzheimer's disease and multiple sclerosis), breast cancer, colon cancer and arthritis. Monitoring the remodelling of the extracellular matrix in response to myocardial infarction. Development of methods to aid understanding of the molecular basis of the disease process. Application of pattern recognition techniques to infrared

spectroscopic data. Supervision of summer students, graduate students, technical officers and postdoctoral workers. Initiation of industrial collaborations. Commercialisation of IR technologies developed at the Institute.

1996-2000: Associate Research Officer, Spectroscopy Group, Institute for Biodiagnostics, NRCC, 435 Ellice Ave., Winnipeg, Manitoba, Canada R3B 1Y6. Development of ex-vivo IR technologies for diagnosis of breast cancer, colon cancer, skin cancer. Development of non-invasive methods for diagnosis of arthritis. Development of non-invasive methods for skin cancer diagnosis. Studying proliferative changes in the synovial membrane in arthritis by infrared microscopy. Monitoring the effects of therapeutic intervention in arthritis by infrared spectroscopy. Development of methods to monitor the effects of UV radiation on skin. Development of non-invasive methods for tumour detection in nude mice. Development of methods for monitoring haemodialysis efficiency. Development of methods to aid understanding of the molecular basis of disease processes. Analysis of spectroscopic data. Supervision of summer students, graduate students, technical officers and postdoctoral workers. Initiation of industrial collaborations. Contract research for industrial clients. Participation in commercialisation of technologies developed at the Institute.

2000-present: Group Leader, Biosystems, Institute for Biodiagnostics, NRCC, 435 Ellice Ave., Winnipeg, Manitoba, Canada R3B 1Y6.

Scientific duties: Development of IR technologies for diagnosis of breast cancer, colon cancer, skin cancer. Development of non-invasive methods for diagnosis of arthritis. Development of non-invasive methods for skin cancer diagnosis. Monitoring the effects of therapeutic intervention in arthritis by infrared spectroscopy. Development of methods to monitor the effects of UV radiation on skin. Development of non-invasive methods for tumour detection in nude mice. Development of methods for monitoring haemodialysis efficiency. Development of spectroscopic methods to aid understanding of the molecular basis of disease processes. Analysis of spectroscopic data. Principle Investigator for the Medical IR beamline at the Canadian Light Source.

Development of optical and magnetic resonance methods to monitor the progression of prion diseases in animals. Evaluation of therapeutic intervention in prion diseases in animals. Magnetic resonance techniques for studying the link between infection and chronic disease. Magnetic resonance techniques for studying the progression of hepatitis in woodchucks. Optical techniques for pathogen identification. Development of a real time on-line monitor for bioterrorism events. Development of novel “molecular imaging” techniques to study progression of infectious diseases.

Management duties: Supervision of 35 Biosystems staff (summer students, graduate students, technical officers, postdoctoral workers and senior NRC scientists). Strategic planning for Biosystems and the Institute for Biodiagnostics. Participation in Institute Management through the Institute Management Committee. Ensure group activities are aligned with NRC strategic priorities. Participate in NRC Genomics and Health Programme Drivers Committee. Initiation of industrial collaborations. Contract research for industrial clients. Commercialisation of technologies developed at the Institute. Management of a \$4.5M “Multimodal Characterisation of Disease” initiative. Preparation and management of new strategic initiatives.

PUBLICATIONS

- 1) **"Fourier transform infrared spectroscopic and differential scanning calorimetric studies of cerebroside polymorphism"** Jackson, M., Johnston, D.S. and Chapman, D. (1989) *Biochim. Biophys. Acta* **944**, 497
- 2) **"Conformational transitions in poly-L-lysine: an FT-IR spectroscopic study"** Jackson, M., Haris, P.I. and Chapman, D. (1989) *Biochim. Biophys. Acta* **998**, 75
- 3) **"Fourier transform infrared spectroscopic studies of lipids polypeptides and proteins"** Jackson, M., Haris, P.I. and Chapman, D. (1989) *J. Mol. Struct.* **214**, 329
- 4) **"Investigation of membrane protein structure using Fourier transform infrared spectroscopy"** Chapman, D., Haris, P.I. and Jackson, M. (1989) *Biochem. Soc. Trans.* **17**, 617
- 5) **"Biomembranes: basic science and future technology"** in *Progress in Clinical and Biological Research* (1989) Chapman, D., Bird, R., Hall, B., Haris, P.I. and Jackson, M. **292**, 3
- 6) **"Fourier transform infrared spectroscopic studies on the secondary structure of the Ca^{2+} -ATPase of sarcoplasmic reticulum."** Villalain, J., Gomez-Fernandez, J.C., Jackson, M. and Chapman, D. (1989) *Biochim. Biophys. Acta* **978**: 305.
- 7) **"Beware of proteins in DMSO"** Jackson, M. and Mantsch, H.H. (1991) *Biochim. Biophys. Acta* **1078**, 231
- 8) **"Valinomycin and its interactions with ions in organic solvents, detergents and lipids studied by Fourier transform infrared spectroscopy"** Jackson, M. and Mantsch, H.H. (1991) *Biopolymers* **31**, 1205
- 9) **"Protein secondary structure from FT-IR spectroscopy: Correlation with dihedral angles from three dimensional Ramachandran plots"** Jackson, M. and Mantsch, H.H. (1991) *Can. J. Chem.* **69**, 1639
- 10) **"FT-IR spectroscopic studies of Ca^{2+} -binding proteins"** Jackson, M., Haris, P.I. and Chapman, D. (1991) *Biochemistry* **30**, 9681
- 11) **"Halogenated alcohols as solvents for proteins: FT-IR spectroscopic studies"** Jackson, M. and Mantsch, H.H. (1991) *Biochim. Biophys. Acta* **1118**, 139
- 12) **"Conformation of magainin-2 and related peptides in aqueous solution and membrane environments probed by Fourier transform infrared spectroscopy."** Jackson, M., Mantsch, H.H. and Spencer, J.H. (1992) *Biochemistry* **31**, 7289
- 13) **"Conformation of the peptide hormone somatostatin in DMSO and aqueous solution"** Jackson, M. and Mantsch, H.H. (1992) *Vibrational Spectrosc.* **3**, 323
- 14) **"Artifacts associated with the determination of protein secondary structure by ATR-IR spectroscopy"** Jackson, M. and Mantsch, H.H. (1992) *Appl. Spect.* **46**, 699
- 15) **"Bioanalytical applications of FT-IR spectroscopy"** Jackson, M. and Mantsch, H.H. (1992) *Trends in Analytical Chemistry* **11**, 206
- 16) **"Biomembrane structure from FT-IR spectroscopy"** Jackson, M. and Mantsch, H.H. (1993) *Spectrochimica Acta Reviews* **15**, 53

- 17) **"Infrared Spectroscopic Characterisation of Alzheimer Plaques"** Fabian, H., Choo, L.-P., Szendrei, G.I., Jackson, M., Otvos, L. and Mantsch, H.H. (1993), *Appl. Spectrosc.* **47**, 1513.
- 18) **"Carbon Dioxide Clathrates: An IR Spectroscopic Marker for Arthritis?"** Eysel, H.H., Jackson, M., Mantsch, H.H. and Thomson, G.T.D. (1993) *Appl. Spectrosc.* **47**, 1519.
- 19) **"Infrared Spectroscopic Characterisation of Multiple Sclerosis Plaques in the Human Central Nervous System"** Choo, L.-P., Jackson, M., Halliday, W.C. and Mantsch, H.H. (1993) *Biochim. Biophys. Acta* **1182**, 333
- 20) **"Interaction of myelin basic protein isoforms with lipid bilayers studied by FT-IR spectroscopy"**, Jackson, M., Choo, L.-P., Boulias, C. Moscarello, M.A. and Mantsch, H.H.(1993) in *Biomolecular Spectroscopy III*, (L.A. Nafie and H.H. Mantsch eds.), *Proc SPIE* **1890**, 9-12
- 21) **"Conformation and self-association of substance P: An FT-IR spectroscopic study"** (1994) Choo, L.-P., Jackson, H.H. and Mantsch, H.H. *Biochem. J.* **301**, 667-670
- 22) **"The structure of the neuropeptide galanin as determined by FT-IR and CD spectroscopy"** (1994) Wernerberg, A., Jackson, M., A. Ohman, A. Graslund, Riegler, R. and Mantsch, H.H. *Can. J. Chem.* **72**, 1495
- 23) **"Beware of connective tissue proteins: Assignment and implications of collagen absorptions in infrared spectra of human tissues."** (1995) Jackson, M., Choo, L.-P., Watson, P.H., Halliday, W.C. and Mantsch, H.H. *Biochim. Biophys. Acta* **1270**, 1-6.
- 24) **"A comparative infrared spectroscopic study of human breast tumours and breast tumour cell xenografts."** (1995) Fabian, H., Jackson, M., Murphy, L., Watson, P.H., Fichtner, I. and Mantsch, H.H. *Biospectroscopy* **1**, 37-46
- 25) **"Neural network classification of infrared spectra of control and Alzheimer's diseased tissue."** (1995) Pizzi, N., Choo, L.-P., Mansfield, J., Jackson, M., Halliday, W.C., Mantsch, H.H. and Somorjai, R.L. *Artificial Intelligence in Medicine* **7**, 67-79.
- 26) **" Infrared spectra of human central nervous system tissue: diagnosis of Alzheimer's disease by mutivariate analysis "** (1995) L.-P. Choo, J. R. Mansfield, N. Pizzi, R.L. Somorjai, M. Jackson, W. C. Halliday and H.H. Mantsch, *Biospectroscopy* **2**, 141-148.
- 27) **"Protein folding intermediates with rapidly exchangeable amide protons contain authentic hydrogen bonded structures"**(1995) I. Guijaro, M. Jackson, A.F. Chaffotte, M. Delepierre, H.H. Manstch and M. E. Goldberg, *Biochemistry* **34**, 2998-3008.
- 28) **"Molecular spectroscopy in biodiagnostics (From Hippocrates to Herschel and beyond)"** (1995) H.H. Mantsch and M. Jackson. *J. Mol. Struct.* **347**, 187-206
- 29) **"The use and misuse of FTIR spectroscopy in the determination of protein structure"** (1995) Jackson, M. and Mantsch, H.H. *CRC Crit. Rev. Biochem. Mol. Biol.* **30**, 95-120.
- 30) **" IR spectroscopy: an insight into diseased tissue"** (1995) Jackson, M and Mantsch, H.H. *Today's Life Science* **7**, S10-15.

- 31) **"Classification of arthritic disorders based upon near-infrared spectra."** Shaw, R.A., Kotowich, S., Eysel, H.H., Jackson, M., Thomson, G.T.D. and Mantsch, H.H. (1995) *Rheumatol. Int.* 15, 159-166.
- 32) **"Biomedical IR spectroscopy"** (1996) M. Jackson and H.H. Mantsch, in *FTIR Spectroscopy* (D. Chapman and H. H. Mantsch, eds) John Wiley, 311-340
- 33) **"FTIR spectroscopy in the clinical sciences"** (1996) M. Jackson and H.H. Mantsch, in *Advances in Spectroscopy vol. 25, Biomedical Applications of Spectroscopy* (R.J.H. Clark and R.E. Hester, eds) John Wiley, 185-215.
- 34) **"Modification of the extracellular matrix following myocardial infarction monitored by FTIR spectroscopy"** (1996) Liu, K.-Z., Jackson, M., Sowa, M.G., Ju, H., Dixon, I.M.C. and Mantsch, H.H. *Biochim. Biophys. Acta* 1315, 73-77
- 35) **"Carbon dioxide in tissue, cells and biological fluids detected by FTIR spectroscopy"** (1996) Schultz, C.P., Eysel, H.H., Mantsch, H.H. and Jackson, M. *J. Phys. Chem.* 100, 6845-6848
- 36) **"In-Situ characterization of β -amyloid in Alzheimer's diseased tissue by synchrotron FTIR microspectroscopy"** (1996) Choo, L.-P., Wetzel, D.L., Halliday, W.C., Jackson, M., LeVine, S.M. and Mantsch, H.H. *Biophys. J.* 71, 1672-1679
- 37) **"A novel diagnostic test for arthritis: Multivariate analysis of infrared spectra of synovial fluid."** (1997) Eysel, H.H., Jackson, M., Nikhulin, A., Somorjai, R.L., Thomson, G.T.D. and Mantsch, H.H. *Biospectroscopy* 3, 161-167.
- 38) **"FTIR/NIR assessment of ischemic damage in the rat heart"** (1997) Sowa, M.G., Mansfield, J. R., Jackson, M., Docherty, J C. Deslauriers, R and Mantsch, H. H. *Mikrochim. Acta* 14, 451-453.
- 39) **"The medical challenge to infrared spectroscopy"** (1997) Jackson, M. and Mantsch, H.H. *J. Mol. Struct.* 408/409, 105-111.
- 40) **"FTIR spectroscopy: A new frontier in medicine"** (1997) Jackson M, Sowa M.G. and Mantsch, H.H. *Biophys. Chem.* 68, 109-125.
- 41) **"Functional group imaging of the jaundiced rabbit liver."** (1998) Jackson, M., Ranmjiawan, B. and Mantsch, H.H. *Cell. Molec. Biol.* 44, 89-98
- 42) **"IR-spectroscopy and IR microscopy of human breast tumors, xenografted breast tumors and breast tumor cell lines."** (1998) Fabian, H., Wessel, R., Jackson, M., Schwartz, A, Lasch, P., Fichtner, I., Mantsch, H.H. and Naumann, D. In *Infrared spectroscopy: a new tool in medicine* (H.H. Mantsch and M. Jackson eds.), Proc SPIE Vol. 3257, 13-23.
- 43) **"Cancer diagnosis by Infrared Spectroscopy: methodological aspects"** (1998) Jackson, M, Kim, K., Tetteh, J., Mansfield, J.R., Dolenko, B., Somorjai, R.L., Orr, F.W., Watson, P.H. and Mantsch, H.H. In *Infrared spectroscopy: a new tool in medicine* (H.H. Mantsch and M. Jackson eds.), Proc SPIE Vol. 3257, 24-34.
- 44) **"Infrared Spectroscopic Characteristics of Normal and Malignant Colonic Epithelium"** (1998) Krupnik, E., Jackson, M., Bird, R.P, Smith, I.C.P and Mantsch, H.H. In *Infrared spectroscopy: a new tool in medicine* (H.H. Mantsch and M. Jackson eds.), Proc SPIE Vol. 3257, 307-310.
- 45) **"Prediction of breast tumour grade and steroid receptor status by pattern recognition analysis of infrared spectra."** Jackson, M., Mansfield, J.R., Dolenko,

- B., Somorjai, R.L., Mantsch, H.H. and Watson, P.H. *Cancer Detection and Prevention* 23, 245-253 (1999).
- 46) **"Infrared spectra of basal cell carcinoma biopsies are distinct from normal epidermis"**. McIntosh, L.M., Jackson, M., Mantsch, H.H. and Crowson, N. J. *Invest. Dermatol.* 112, 951-956 (1999)
 - 47) **"Analysis and interpretation of infrared microscopic maps: visualisation and classification of skin components by digital staining and multivariate analysis"** McIntosh, L. M., Mansfield, J.R., Crowson, A. N., Mantsch, H.H. and Jackson, M. *Biospectroscopy*, 5, 265-275 (1999).
 - 48) **"A LDA-guided search engine for the non-subjective analysis of infrared microscopic maps"** Mansfield, J.R., McIntosh, L. M., Crowson, A. N., Mantsch, H.H. and Jackson, M. *Appl. Spectrosc.* 53: 1323-1330, (1999)
 - 49) **"Altered electrophysiological expression of synaptic plasticity and infrared spectroscopic tissue composition in long term b-amyloid treated rats."** T.P. Hicks, N.V. Krateniakov, M. Jackson, S.M. Donnelly, B. Chakravarthy, L. Ohannessian and J.-I. Oka. *Acta Medica et Biologica* 48, 31-38, (2000).
 - 50) **"Medical Science Applications of Infrared Spectroscopy"** Jackson, M. and Mantsch, H.H. *Encyclopaedia of Spectroscopy and Spectrometry*, Vol. 2 (London, J.C., Tranter, G.E. and Holmes, J.L., Eds.) New York: Academic Press, 1999, 1271-1281
 - 51) **"Ex-vivo analysis of tissues"** Jackson, M. and Mantsch, H.H. *Encyclopedia of Analytical Chemistry*, Vol. 1 (Meyers, R.A., Ed.) Chichester: John Wiley & Sons, 2000, 131-156.
 - 52) **"Fluorescence imaging"** Ramjiawan, B., Jackson, M and Mantsch, H., *Encyclopedia of Analytical Chemistry*, 5-20, (2000).
 - 53) **"Classification of infrared spectra of tumors"**. McIntosh, L. M., Mansfield, J.R., Crowson, A. N., Toole, J. W.P., Mantsch, H.H. and Jackson, M. *Proc. SPIE* 3907, 126-135 (2000).
 - 54) **"Non-Invasive Localization of Tumors by Immunofluorescence Imaging Using a Single Chain Fv Fragment of a Human Monoclonal Antibody With Broad Cancer Specificity."** B. Ramjiawan, P. Maiti, A. Aftanas, H. Kaplan, D. Fast, H. H. Mantsch and M. Jackson. *Cancer* 89, 1134-1144, (2000).
 - 55) **"The Impact of Infrared Synchrotron Radiation in Biology: Past, Present, and Future"** L.M. Miller, G.L. Carr, M. Jackson G.P. Williams, and P. Dumas *Synchrotron Radiation News* (2000).
 - 56) **"Non-invasive characterisation of skin lesions by near infrared spectroscopy"** L. M. McIntosh, R. Summers, M. Jackson, H. H. Mantsch, J. R. Mansfield, M. Howlett, A. N. Crowson, and J. W.P. Toole. *J. Invest. Dermatol.* 116, 175-181 (2001)
 - 57) **"Protein-Ligand Interactions Studied by FTIR Spectroscopy: Methodological Aspects."** Jackson, M. and Mantsch, H.H. in *Protein-Ligand Interactions: A Practical Approach*. Volume 243, 239-264 (2001).
 - 58) **"Vibrational Spectroscopy and Pathology"** M. Jackson and H. H. Mantsch in *Handbook of Vibrational Spectroscopy*, (Chalmers, J.M. and Griffiths, P.R., Eds.) Chichester: John Wiley & Sons, 2002,

- 59) **"Ex-vivo Vibrational Spectroscopy Imaging"** L.M. McIntosh and M. Jackson, in Handbook of Vibrational Spectroscopy, (Chalmers, J.M. and Griffiths, P.R., Eds.) Chichester: John Wiley & Sons, 2002.
- 60) **"Infrared Spectroscopic Studies of Biological Membranes"** M. Jackson, D. J. Moore, H.H. Mantsch and R. Mendelohn) in Handbook of Vibrational Spectroscopy, (Chalmers, J.M. and Griffiths, P.R., Eds.) Chichester: John Wiley & Sons, 2002,
- 61) **"Near-Infrared Spectroscopy for Dermatological Applications"**. L. M. McIntosh, R. Summers, M. Jackson, H. H. Mantsch, J. R. Mansfield, M. Howlett, A. N. Crowson, and J. W.P. Toole. *Vib. Spectrosc.* 28: 53-58, 2002
- 62) **"In Vivo monitoring of the Distribution of a Monoclonal Antibody Fragment"**. Ramjiawan, B., Aftanas, A., Kaplan, H., Fast, D., Maiti, P., Mantsch H.H. and Jackson M. *Vib. Spectrosc.* 28: 177-188, 2002
- 63) **"Immunofluorescence imaging as a tool for studying the pharmacokinetics of a human monoclonal single chain Fv fragment antibody"**. B., Ramjiawan, R.E., Ariano, H.H. Mantsch, P. Maiti, and Jackson, M. *IEEE Trans. Med. Imaging* 21: 1317-1323, 2002
- 64) **"Increased pressure during retrograde cerebral perfusion in an acute porcine model improves brain tissue perfusion without increase in tissue edema."** Li, Z., Yang, L., Jackson, M., Summers, A., Donnelly, M., Deslauriers, R. and Ye, J. *Ann. Thorac. Surg.* 73: 1514-1521, 2002
- 65) **"Infrared Spectroscopy: Shedding Light on Synovitis in Patients with Rheumatoid Arthritis"** J.M.G. Canvin, S. Bernatsky, M. Jackson, M.G. Sowa, J.R. Mansfield, H.H. Eysel, H.H. Mantsch and H. El-Gabalawy. *Rheumatology* 42, 76-82. (2003)
- 66) **"Scrapie infection investigated by magnetic resonance imaging and Fourier transform infrared microscopy"** J. Dubois, R. Baydack, E. McKenzie, T. Booth, and M. Jackson. *Vib. Spectrosc.* 32 95-105 (2003).
- 67) **"From Biomolecules to Biodiagnostics: Spectroscopy does it all"** M. Jackson *Faraday Discuss.* 126, 1-18 (2004)
- 68) **"Infrared Microscopy as a tool for probing tissues"** M. Jackson. *Physics in Canada* 60 (2004)
- 69) **"Use of a pH-stat strategy during retrograde cerebral perfusion improves cerebral perfusion and tissue oxygenation"** J. Ye, Z. Li, Y. Yang, Luojia Yang, A Turner, M. Jackson and R. Deslauriers. *Annals of Thoracic Surgery* Volume 77, 1664-1670 (2004)
- 70) **"Unclamping the inferior vena cava during retrograde cerebral perfusion increases the safety margin of retrograde perfusion pressures and improves brain perfusion."** Li Z, Yang L, Jackson M, Summers R, Deslauriers R, and Ye J *Eur J Cardiothorac Surg/Interactive Cardiovascular and Thoracic Surgery* (accepted December, 2003)
- 71) **"Use of a pH - stat strategy during retrograde cerebral perfusion improves cerebral perfusion and tissue oxygenation"** Jian Ye, Zhijun Li, Yanmin Yang, Luojia Yang, Allan Tuner, Michael Jackson and Roxanne Deslauriers (2004). *Ann Thorac Surg* 77: 1664-1670
- 72) **"Is maintaining cerebral hypothermia the principal mechanism by which retrograde cerebral perfusion provide better brain protection than hypothermic**

circulatory arrest? A study in a porcine model.” Li Z, Yang L, Summers R, Jackson M, Deslauriers R, Ye J. (2004) J Card Surg 19: 28

Selected invited presentations

1. **“Applications of spectroscopic techniques in medicine”** Dept. Immunology, University of Manitoba, Manitoba, Canada, January 1998.
2. **“FTIR Spectroscopy: A New Tool in Medicine, BIOS’98”** Conference co-chair, San Jose, USA, January 1998.
3. **“Cancer detection by infrared spectroscopy: methodological aspects”** FTIR Spectroscopy: A New Tool in Medicine, BIOS’98 San Jose, USA, January 1998.
4. **“The medical challenge to vibrational spectroscopy”**, organiser and moderator of round table discussion at FTIR Spectroscopy: A New Tool in Medicine, BIOS’98 San Jose, USA, January 1998.
5. **“Prediction of breast tumour grade and steroid receptor status by multi-variate analysis of Fourier transform infrared spectra.”** PittCon New Orleans, March 1998.
6. **“Spectroscopy as a tool in medicine”** Dept. Surgery, University of Newcastle, UK April 1998.
7. **“Novel Spectroscopic techniques for disease diagnosis”** University of Winnipeg, October 1998.
8. **“Diagnosis of skin and breast cancer by FTIR spectroscopy”**., FAACS, Austin, Texas, USA, October 1998.
9. **“Applications of synchrotron radiation in infrared spectroscopic studies of cells and tissues”**. Canadian Light Source meeting, Montreal, March 1999.
10. **“From biomolecules to biodiagnostics: Applications of infrared spectroscopy in the diagnosis of disease.”** Canadian Federation of Biological Sciences meeting, Winnipeg, June 1999.
11. **“Synchrotron-based infrared microscopy: the future”**. Canadian Light Source, Saskatoon, September 1999.
12. **“Imaging Skin Lesions”** Federation of Analytical Chemistry and Spectroscopy Societies annual meeting Vancouver, October 1999.
13. **“Spectroscopy and Tissue Analysis: Where Next?”** Shedding New Light On Disease: Optical Diagnostics for the New Millenium, Winnipeg, Manitoba, June 2000
14. **Spectroscopic techniques for studying disease processes”** Colloquium Spectroscopicum, June 2000, South Africa
15. **“Microscopic Imaging of Tissues”**, Invited speaker, International Union of Microbeam Analysis Societies, Hawaii, July 2000
16. **“Biophysical methods for studying skin”** Unilever Research Inc, Edgewater, New Jersey 2000
17. **Synchrotron Radiation: Applications in Biology and Medicine:** Lawrence Berkeley National Laboratory, September 2001
18. **“Infrared imaging and pathological analysis of tissues: data acquisition, analysis and interpretation”** PittCon 2002, New Orleans, USA.
19. **“Imaging and spectroscopy in disease detection”** Microscopy and Microanalysis, Quebec City, July 2002

20. **"Biophysical methods for monitoring disease"** International Biophysics Congress, Buenos Aires March 2002
21. **"Imaging techniques for tracking biologics."** Shedding New Light On Disease: Optical Diagnostics for the New Millenium, Reims, France, June 2002
22. **"Optical imaging as a diagnostic tool"** Optical Society of America Annual meeting, Quebec City 2003
23. **"Mining the Human Body: From Blood to Skin."** PittCon 2003, Orlando, US. March
24. **"Spectroscopy of tissues."** Microscopy and Microanalysis, San Antonio, August 2003
25. **"From biomolecules to biodiagnostics: spectroscopy does it all"** Faraday Society Discussion Group 126: Applications of Spectroscopy to Biomedical Properties. September 2003
26. **"Biological imaging from a biologists perspective."** Eastern Analytical Society, Somerset, New Jersey, October 2003. (Jackson)
27. **"Application of vibrational microscopy in tissue analysis: where do we go from here?"** Microscopy and Microanalysis, Savannah, August 2004
28. **"Molecular Imaging: A Convergence of technologies"** ICMEMS 2004, Banff. August 2004.

PATENTS

- 1) **"Method for diagnosing arthritic disorders by infrared spectroscopy"** Eysel, H.H., Jackson, M. and Mantsch, H.H.(1995) United States Patent 5,473,160.
- 2) **"A novel method for non-invasive diagnosis of rheumatoid arthritis".** Jackson, M. Sowa, M., Eysel, M., Mansfield, M., Canvin, M., El-Gabalawy, H., Mantsch, H.H.
- 3) **" A spectroscopic method for the non-invasive classification of skin lesions"** McIntosh, L.M., Jackson, M., Mantsch, H.H., Crowson, A.N., Toole, J.
- 4) **"Immunofluorescence compound for imaging of tumors".** Ramjiawan, B., Maiti, P., Aftanas, A., Kaplan, H., Fast, D., Mantsch, H.H., Jackson, M.